DELAWARE AQUEDUCT REPAIR PROJECT

Final Connection and Water Supply Management Plan

Agenda

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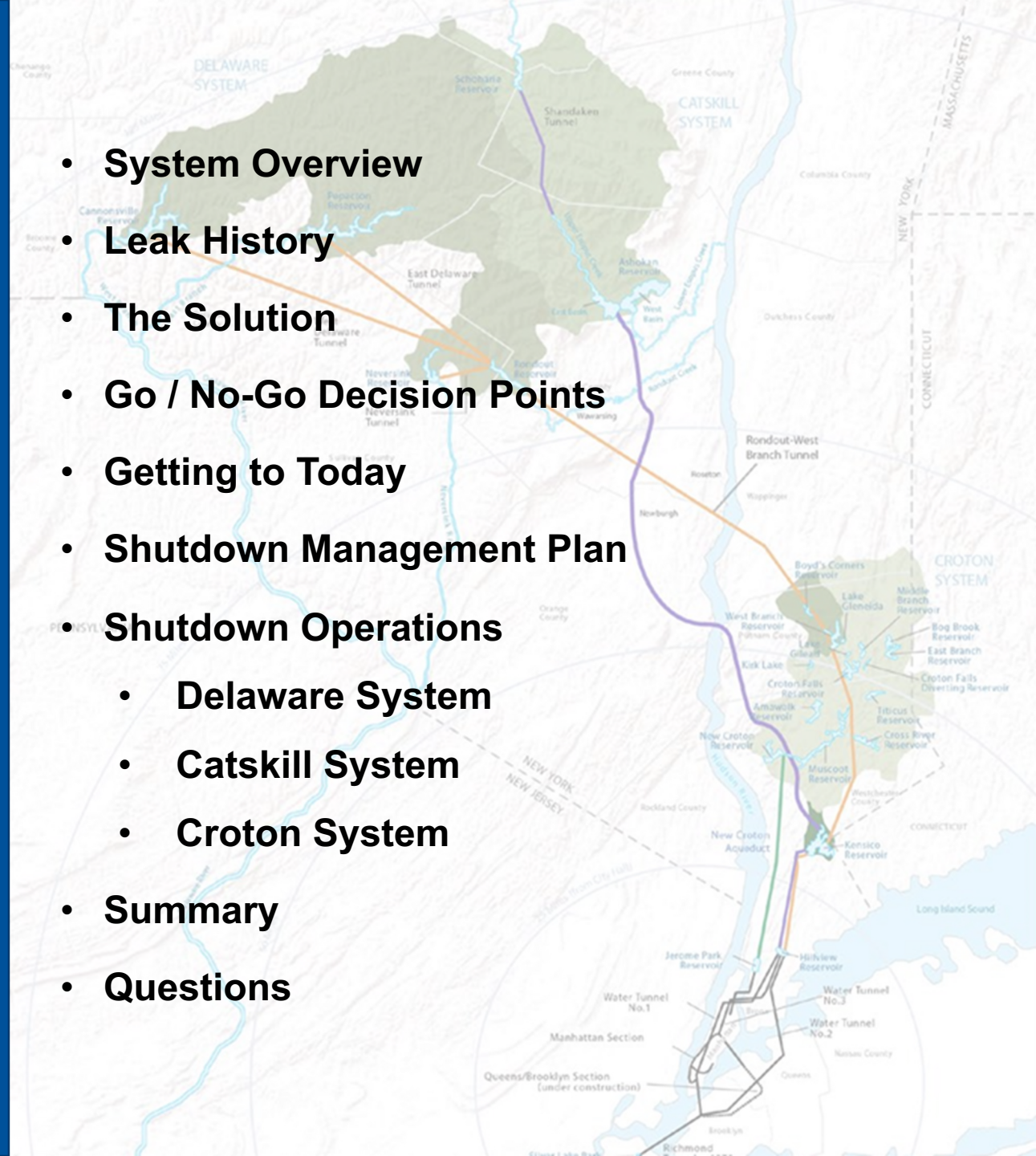
NYC Environmental Protection

- System Overview
- Leak History
- The Solution
- Go / No-Go Decision Points
- Getting to Today
- Shutdown Management Plan
- Shutdown Operations
  - Delaware System
  - Catskill System
  - Croton System
- Summary
- Questions



System Overview

- 19 reservoirs & 3 controlled lakes
- System Capacity: 570 billion gallons
- Delivers approx. 1.1 billion gallons per day to 9.8 million people in New York City and 4 counties north of the City.
- Source of water is a 2,000 square mile watershed (the size of the State of Delaware) spread across 8 upstate counties

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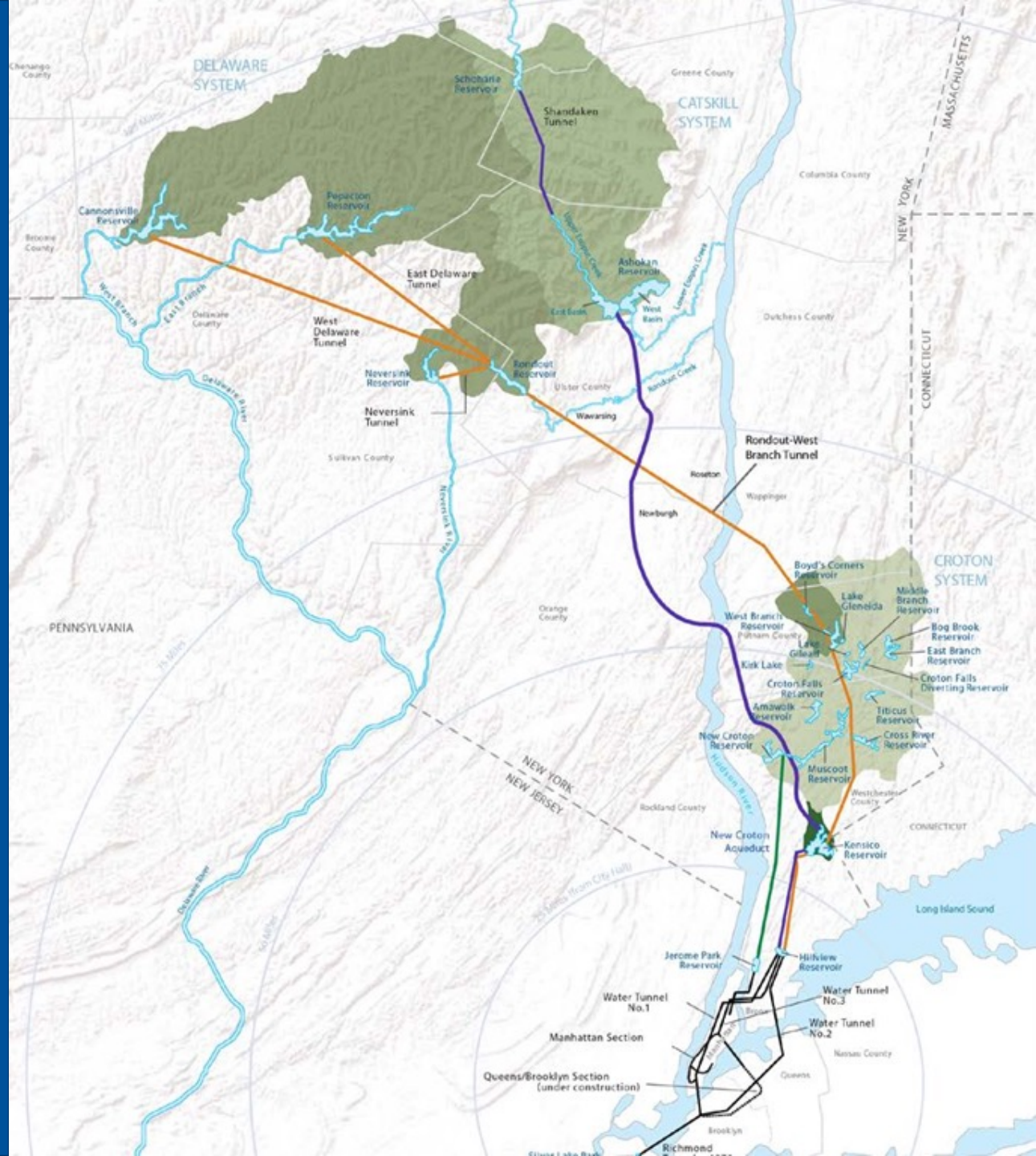
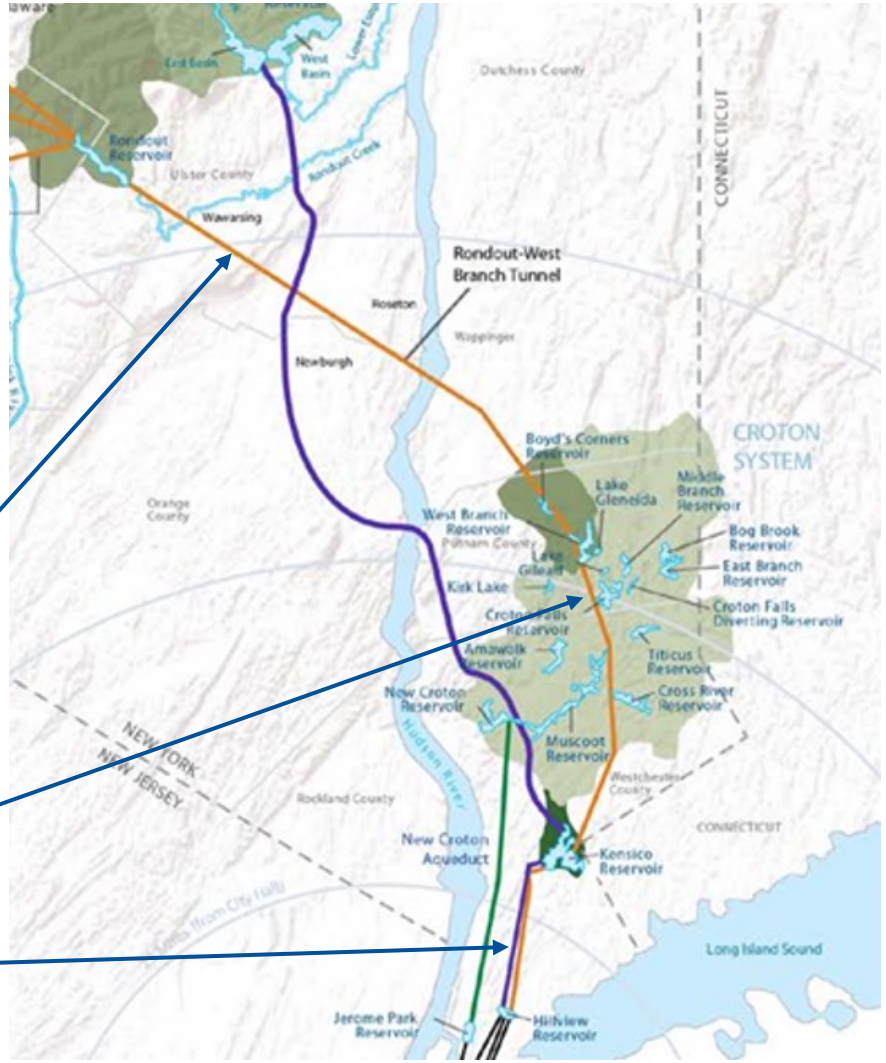


Delaware Aqueduct

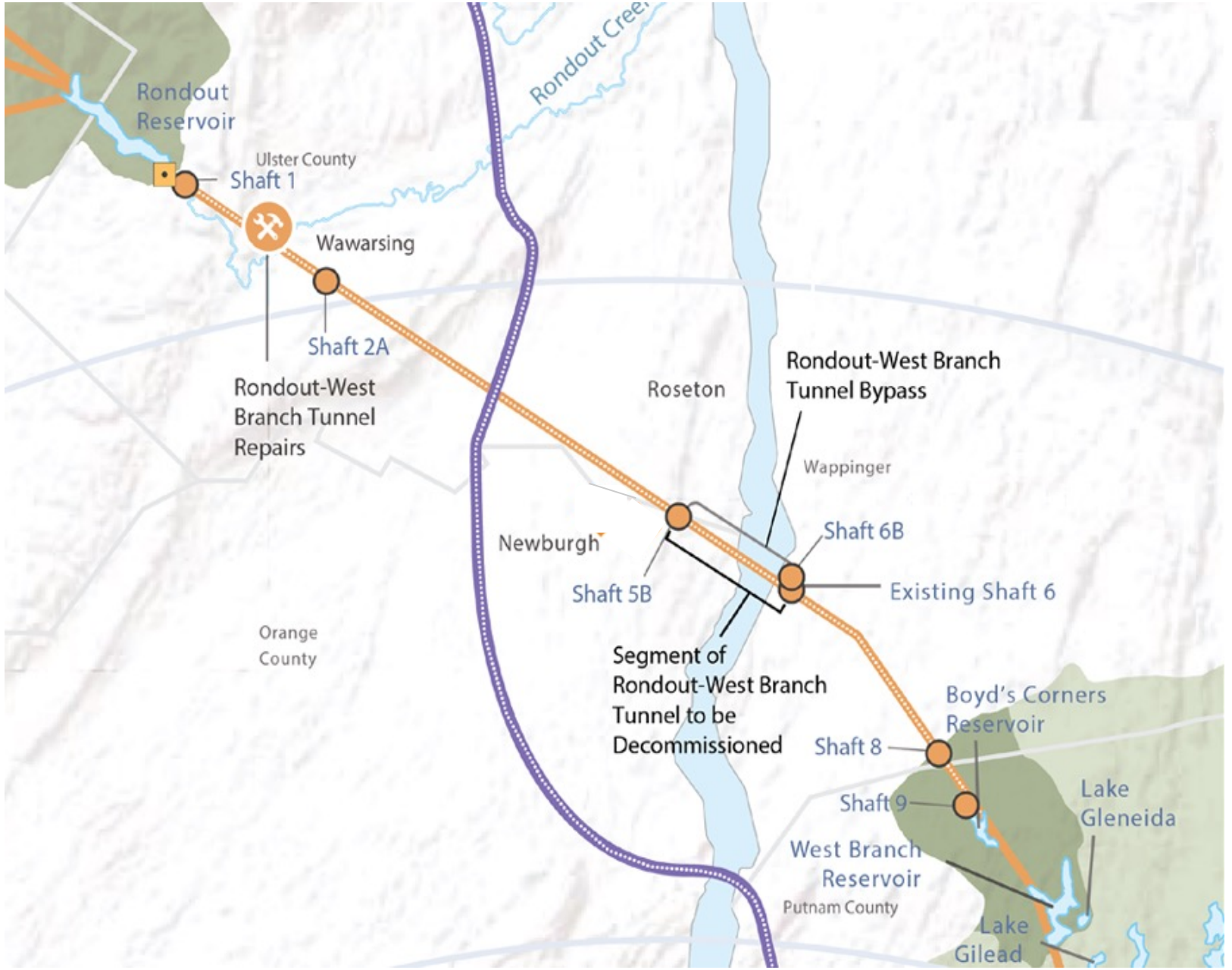
- 85 miles long from Rondout to Hillview Reservoir
- Longest tunnel in the world
- Conveys about 50 percent of NYC drinking water on average
- In service since 1944
- Last fully drained for inspection 1957-1958
- Critical system component
- Aqueduct consists of three segments
  - Rondout to West Branch (44 mi.)
  - West Branch to Kensico (27 mi.)
  - Kensico to Hillview (14 mi.)



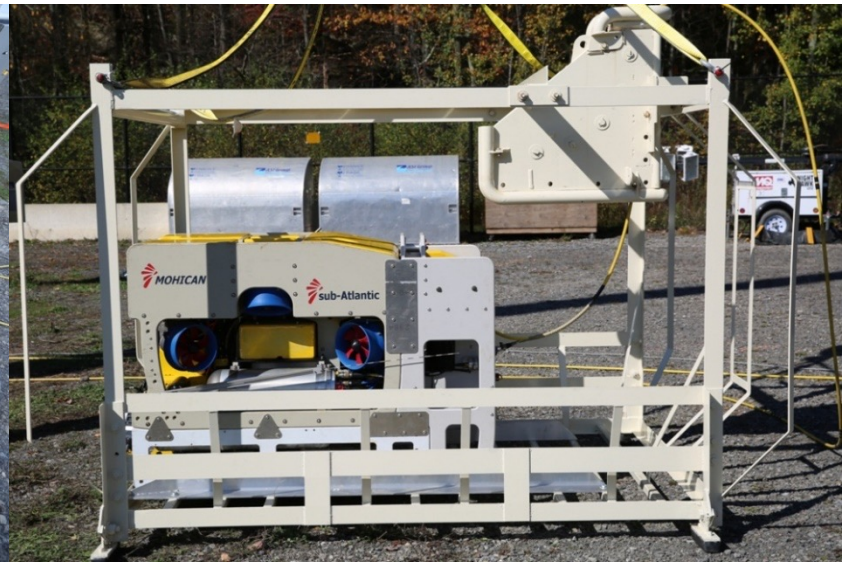
Leaks Discovered

- Leak identified in late 1990 at CHG&E Roseton generating station north of Newburgh
- Leak identified in 1992 in the Ulster County Town of Wawarsing
- Total leakage rate estimated at more than 30 million gallons per day
- About 95 percent of the leakage is from the area at Roseton near Newburgh
- Difficult conditions encountered during aqueduct construction – faulted limestone
- Steel inter-lining installed through these sections to provide support for the tunnel

Primary Areas of Concern

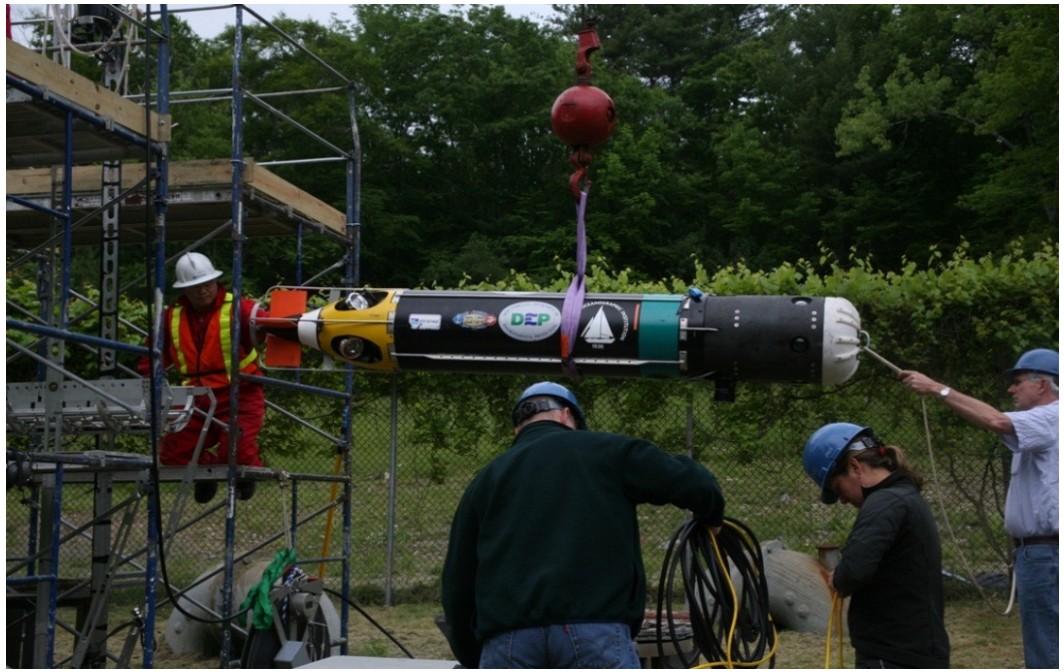


Leak Investigation



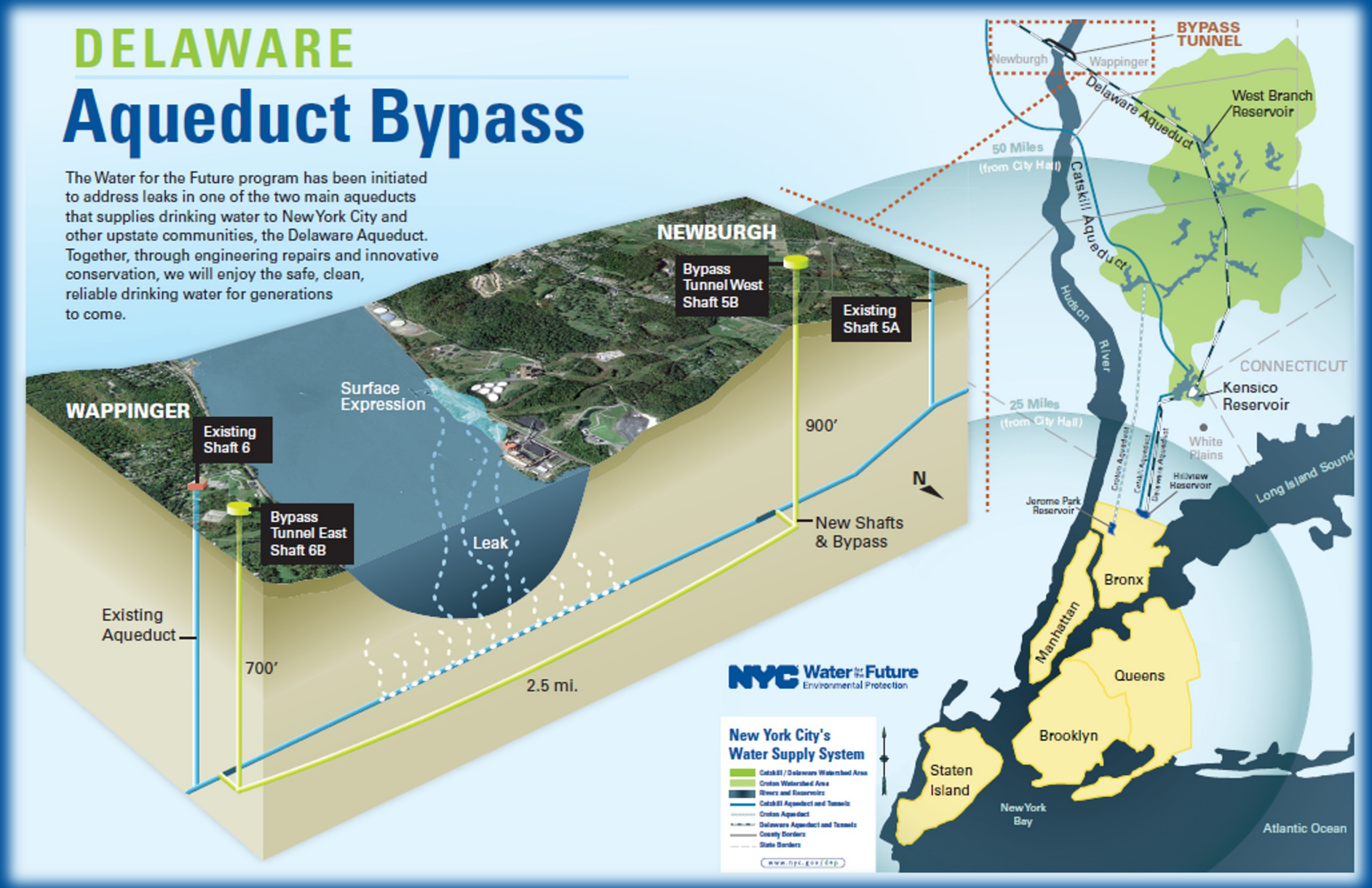
Top: Remotely Operated Vehicle (ROV) used in 2015 to investigate leak locations in Wawarsing

Bottom: Autonomous Underwater Vehicle (AUV) used in 2004, 2009, 2014 to investigate the Rondout-West Branch segment near Newburgh



March 2023 aqueduct shutdown and partial dewatering test measuring groundwater infiltration (the first such draining in nearly 70 years). Additional shutdown and dewatering test anticipated in fall 2023

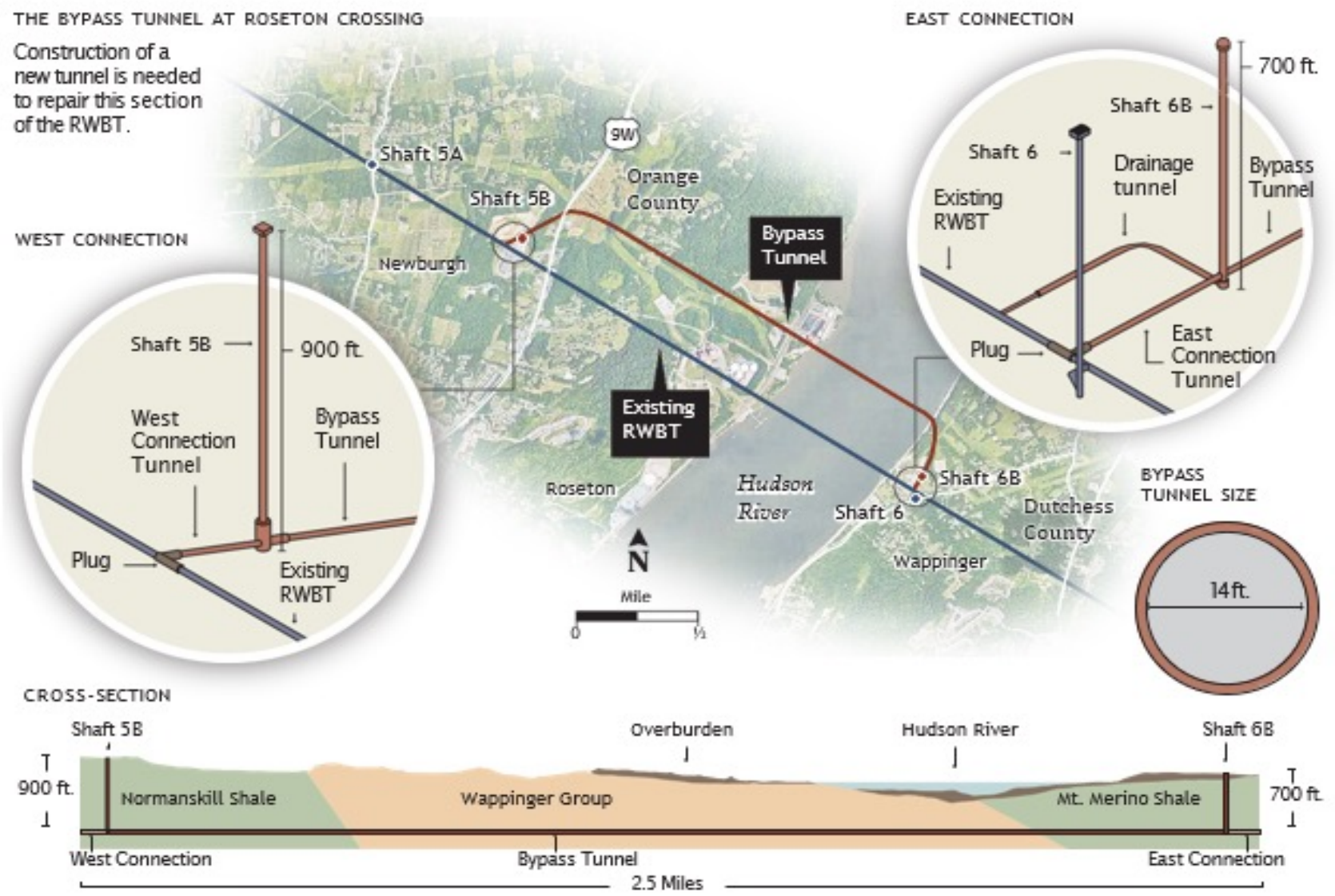
The Solution!



Delaware Aqueduct Bypass Tunnel

- Largest and most complex repair project in the 180-year history of NYC's municipal water supply
- Tunnel program cost $1 billion
- Fixing or eliminating leaks in the Delaware Aqueduct
- Building and connecting a new 2.5-mile-long tunnel 600 feet below the Hudson River from Newburgh to Wappinger
- First tunnel under Hudson River since the south tube of the Lincoln Tunnel was completed in 1957

Bypass Tunnel to Connect at Both Ends Under Hudson



Delaware System Must Shut Down for Final Connection of Bypass Tunnel

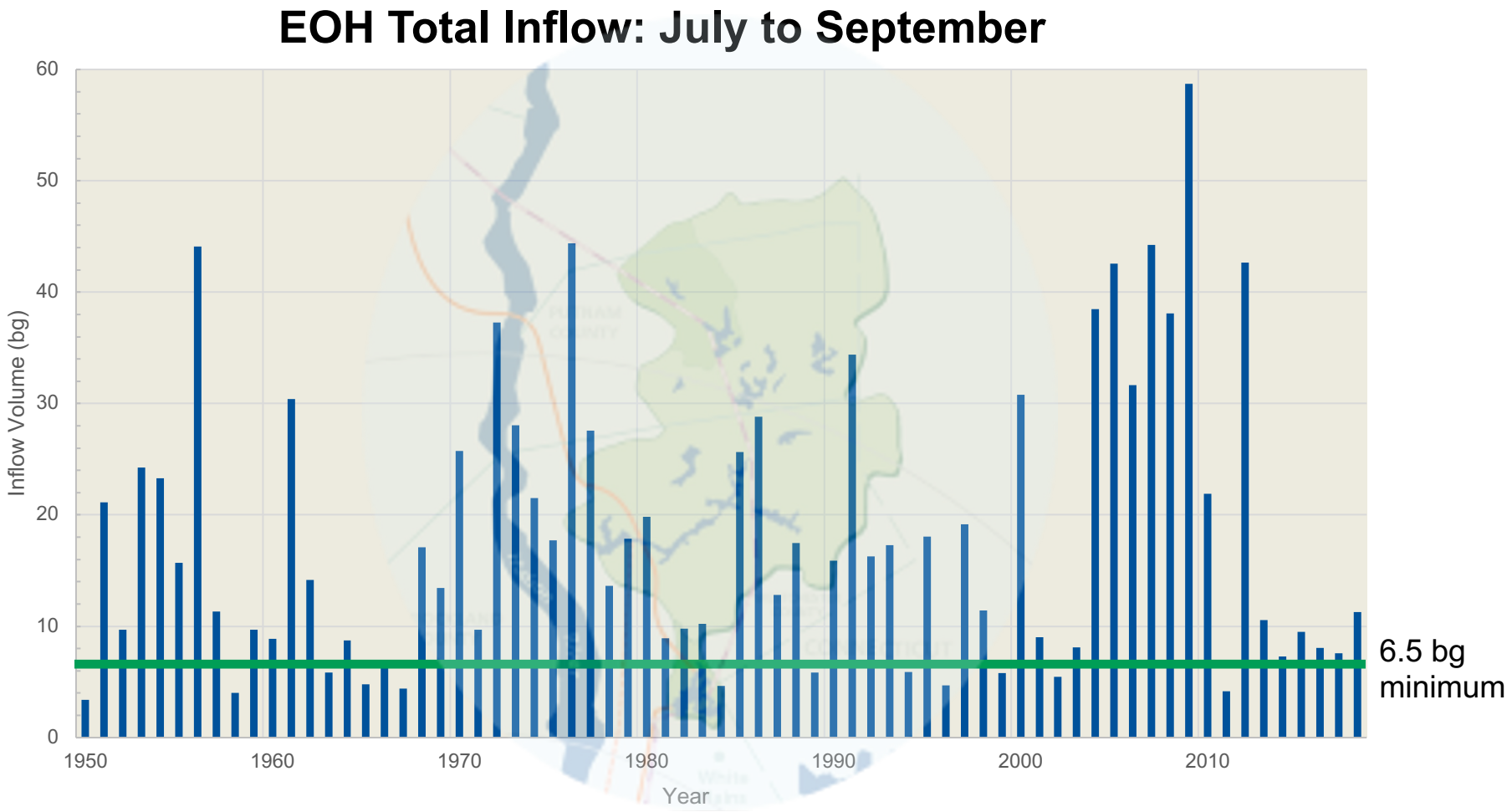
- Bypass tunnel section mostly complete in 2021
- Ready to Connect
- Shutdown Delaware System and fully dewater compromised sections of tunnel
- Attach bypass to structurally sound sections and create new route around leak
- Plug and decommission compromised section under the Hudson
- Grout the Wawarsing Leak
- 8 months to complete connection work

Go/No-Go Decision Points Leading Shutdown

- Water supply hydrological conditions
- Infrastructure conditions
- If “no go” decision is made plan would be for the same period the next year

Go/No-Go Decision Points: Hydrologic Conditions

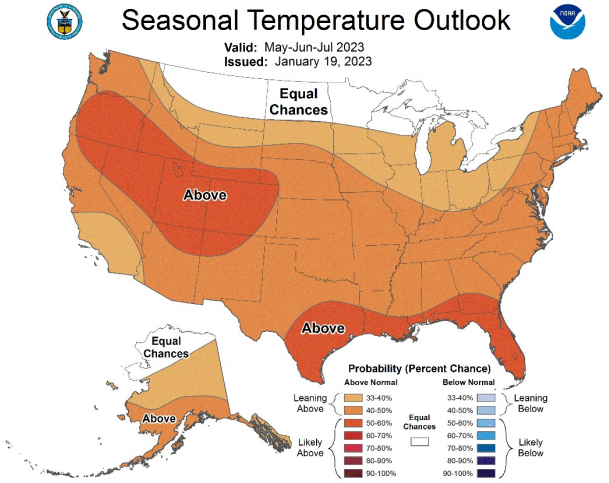
- **East of Hudson (EOH) inflow must be greater than 6.5 billion gallons** to commence shutdown.
- Historically, July-September EOH inflow was above 6.5 billion gallons 80% of the time.



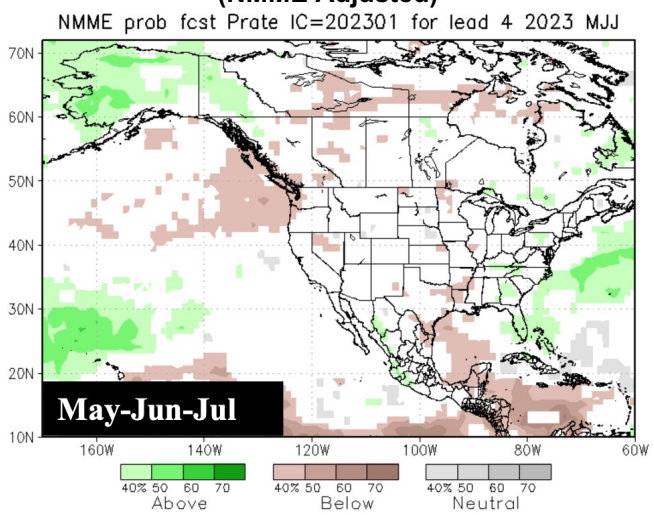
Go/No-Go Decision Points: Weather Prediction

Extended Temperature and Precipitation Forecast May 2023 – Jul 2023

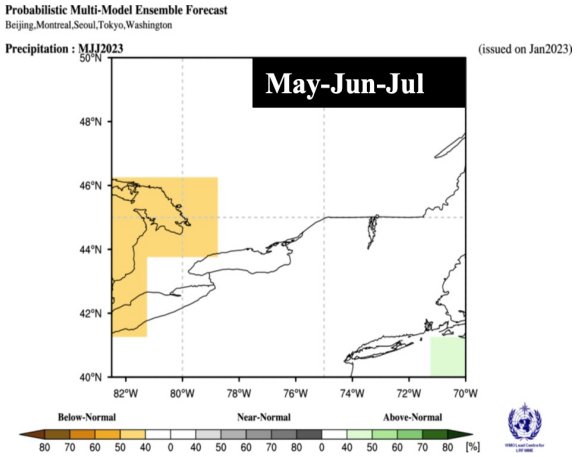
NOAA's Climate Prediction Center



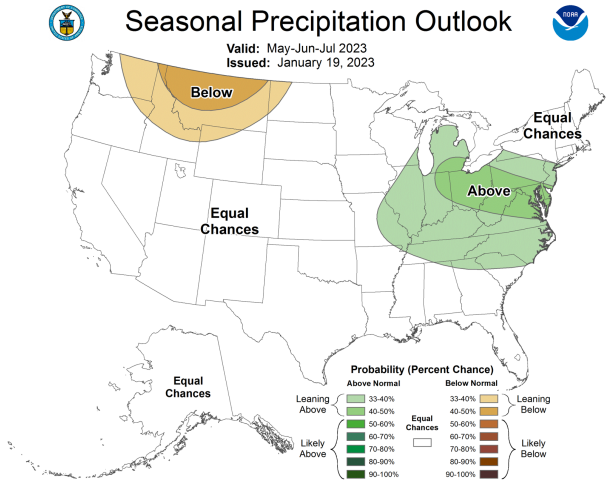
NOAA's Climate Prediction Center (NMME Adjusted)



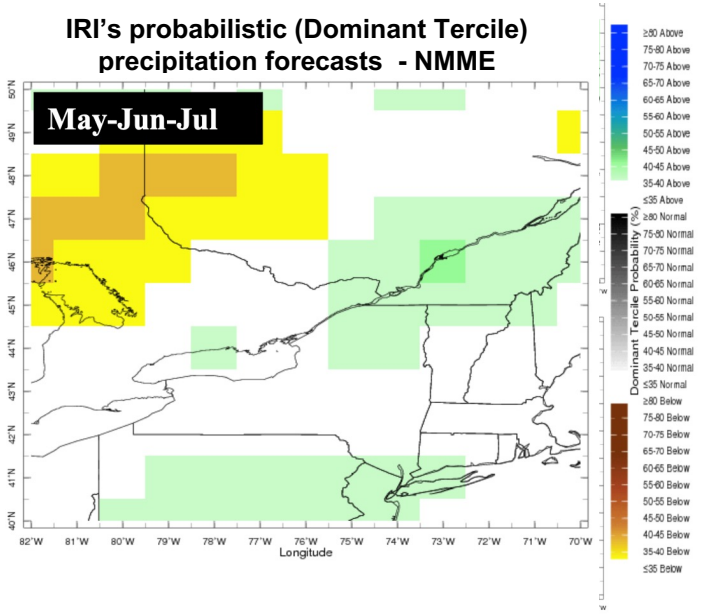
WMO Lead Centre



DEP is using multiple long-term weather prediction services to assist modeling shutdown operations



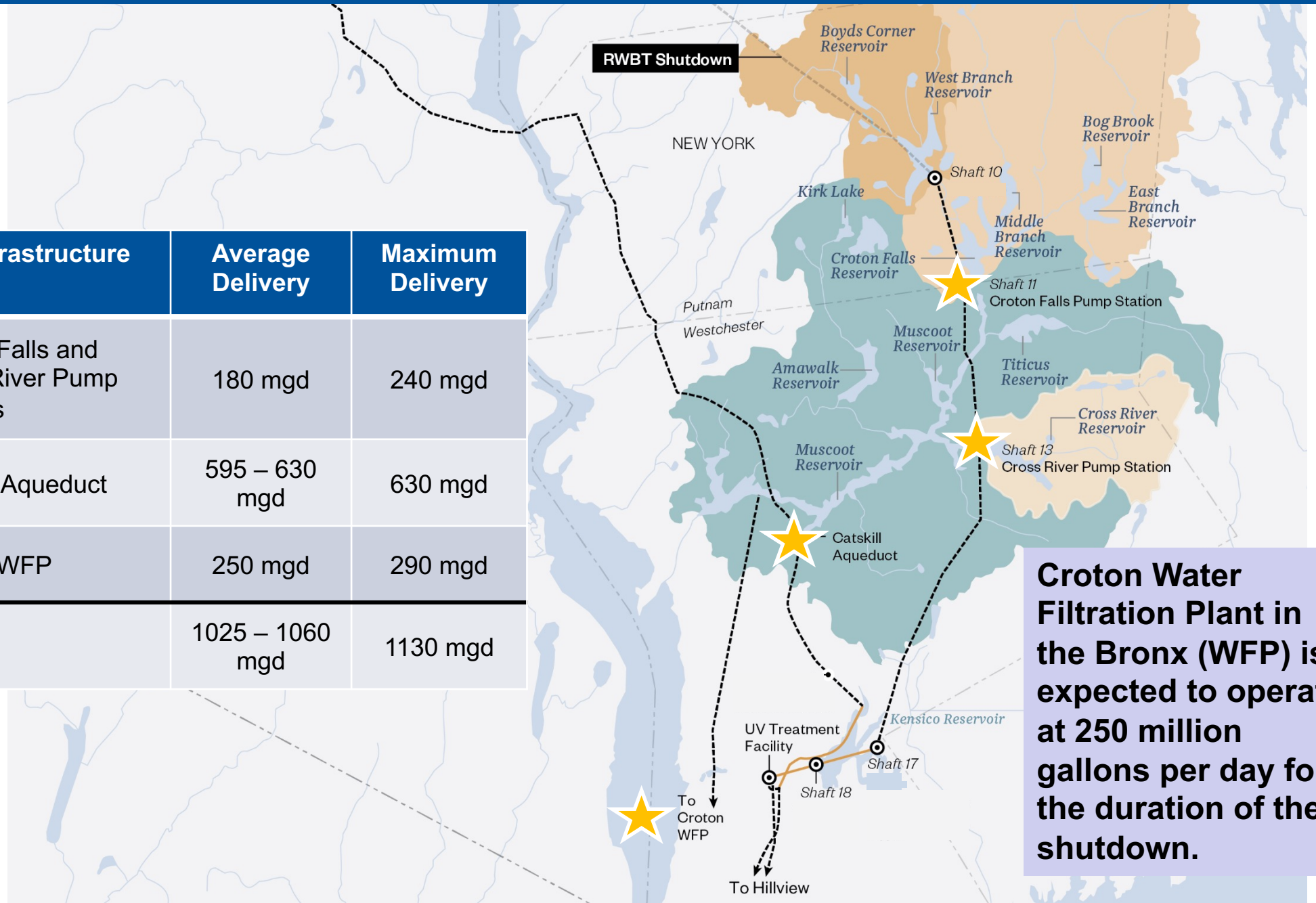
IRI's probabilistic (Dominant Tercile) precipitation forecasts - NMME



All "go" / "no go" and potential project bailout decisions are made in real time based on precision data and in coordination with expert and regulatory partners. Bailout return-to-service during shutdown can take between 1 and 9 weeks.

Go/No-Go Decision Points: Key Infrastructure

Key Infrastructure	Average Delivery	Maximum Delivery
Croton Falls and Cross River Pump Stations	180 mgd	240 mgd
Catskill Aqueduct	595 – 630 mgd	630 mgd
Croton WFP	250 mgd	290 mgd
Total	1025 – 1060 mgd	1130 mgd



Croton Water Filtration Plant in the Bronx (WFP) is expected to operate at 250 million gallons per day for the duration of the shutdown.

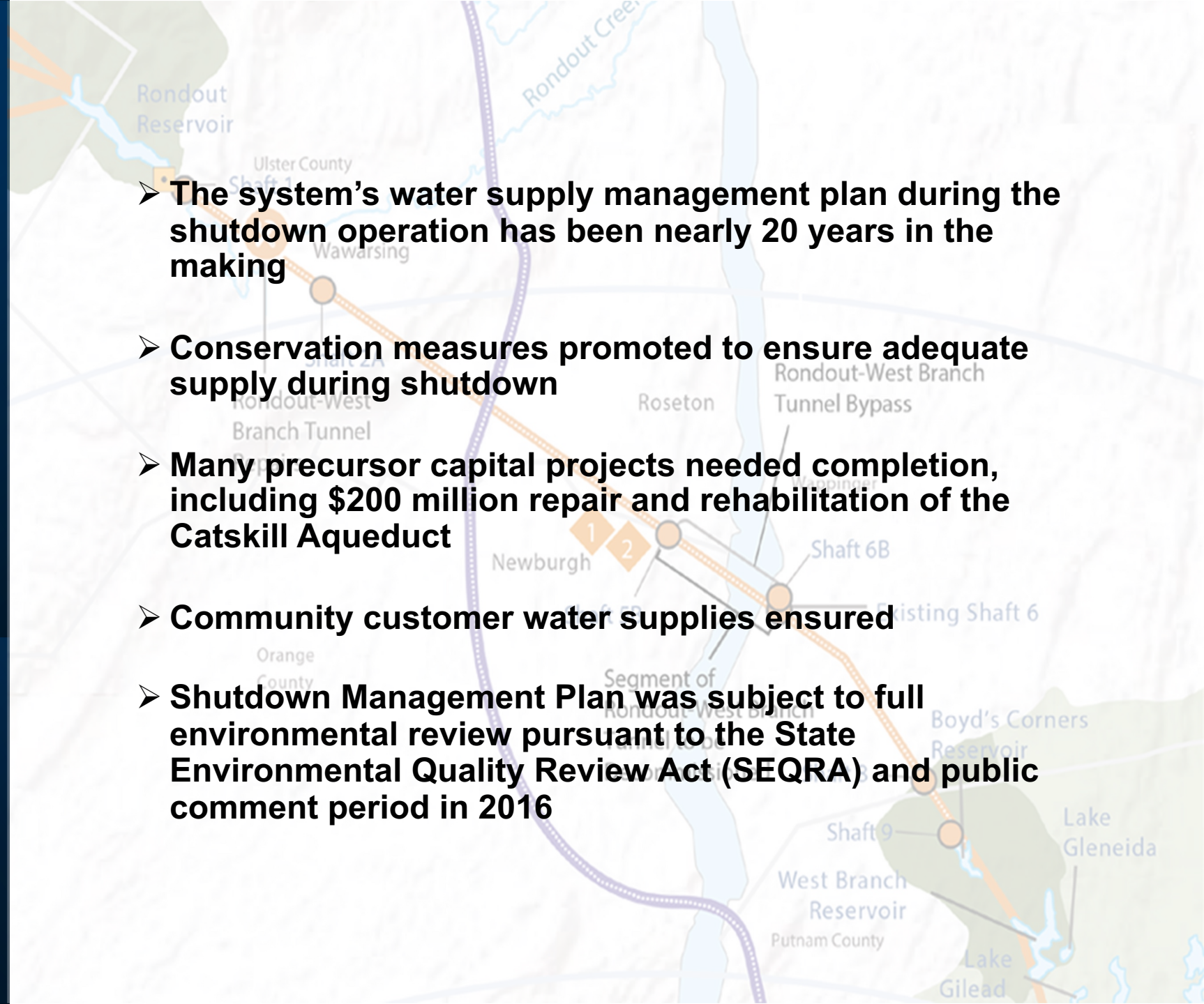
Getting to Today

The shutdown and bypass tunnel connection could not be completed when the bypass tunnel was constructed

- **to ensure redundancy of several water supply systems in communities north of the City;**
- **to finalize a new connection between the Croton System and the City water supply in the Bronx;**
- **to enhance tunnel dewatering pump capacity; and**
- **for upgrades and testing of pump stations in the Hudson Valley.**

Getting to Today

- The system's water supply management plan during the shutdown operation has been nearly 20 years in the making
- Conservation measures promoted to ensure adequate supply during shutdown
- Many precursor capital projects needed completion, including $200 million repair and rehabilitation of the Catskill Aqueduct
- Community customer water supplies ensured
- Shutdown Management Plan was subject to full environmental review pursuant to the State Environmental Quality Review Act (SEQRA) and public comment period in 2016



Getting to Today

- **Precursor Projects Critical to RWBT Shutdown**
- **CAT-212D:** Shandaken Tunnel Intake Chamber Improvements
- **CAT-213E/F:** Chemical Addition Facilities for the Catskill System
- **BT-2:** Rondout Siphons
- **DEL-424:** Structural Stabilization of Honk Falls Dam
- **CAT-RR:** Catskill Aqueduct Repair and Rehabilitation
- **DEL-418C:** Town of Newburgh Backup Supply
- **CRO-346CF:** Upgrades at Croton Falls Pump Station
- **CRO-543:** Shoreline Stabilization at Kensico Reservoir
- **CRO-521:** Jerome Park Reservoir Work

Requisite Dewatering Test

- On March 6, 2023, DEP shut down the Delaware Aqueduct and began the process of dewatering the tunnel to an elevation of –90 feet below sea level, the first such draining in nearly 70 years
- The two-week shutdown enabled DEP to perform critical infrastructure and hydrological tests before beginning the final connection phase
- An engineering analysis of the new data obtained from the March shutdown concluded that the level of groundwater infiltration potentially exceeded the capacity of tunnel dewatering systems
- Safety of the workers 700 feet below ground is paramount

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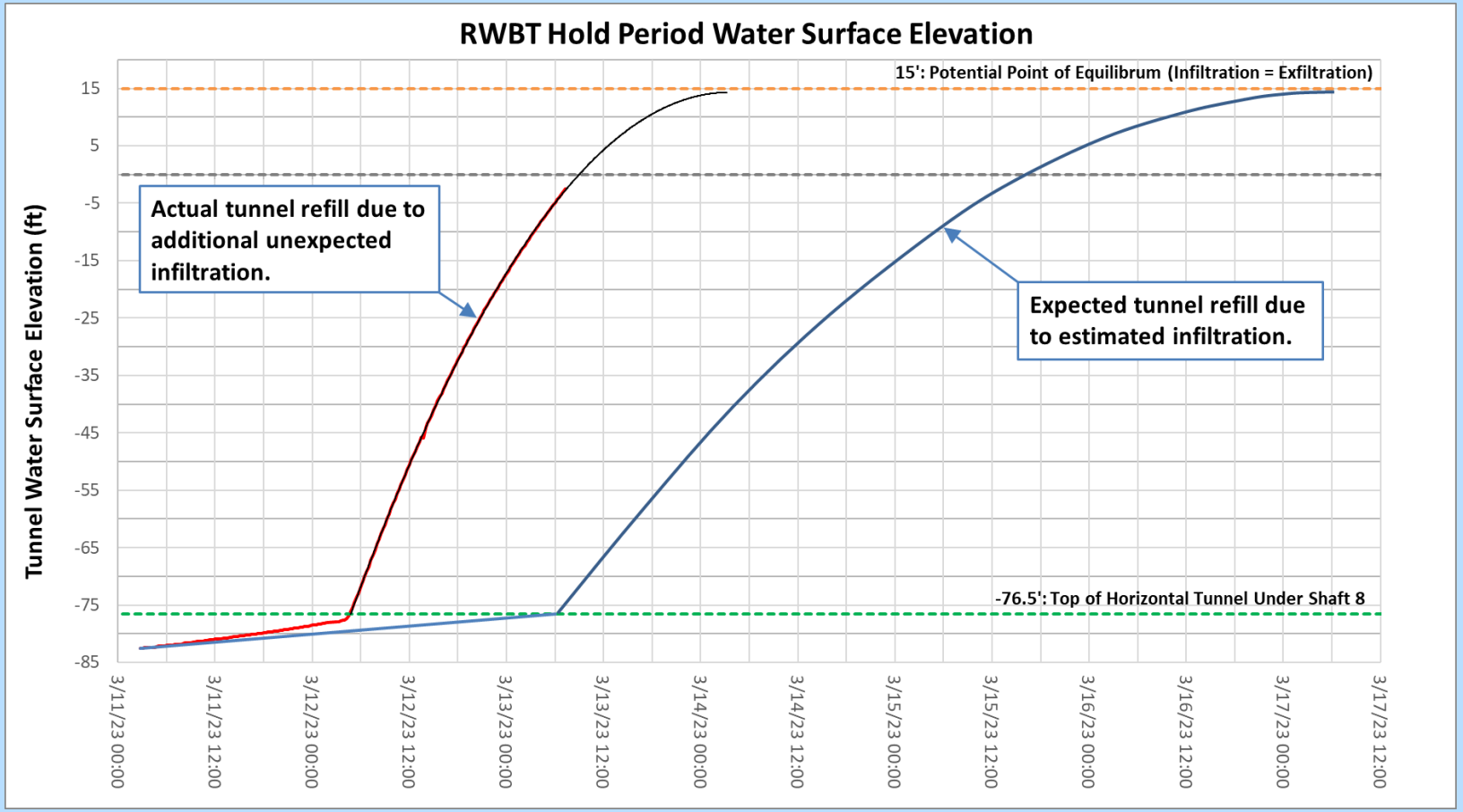
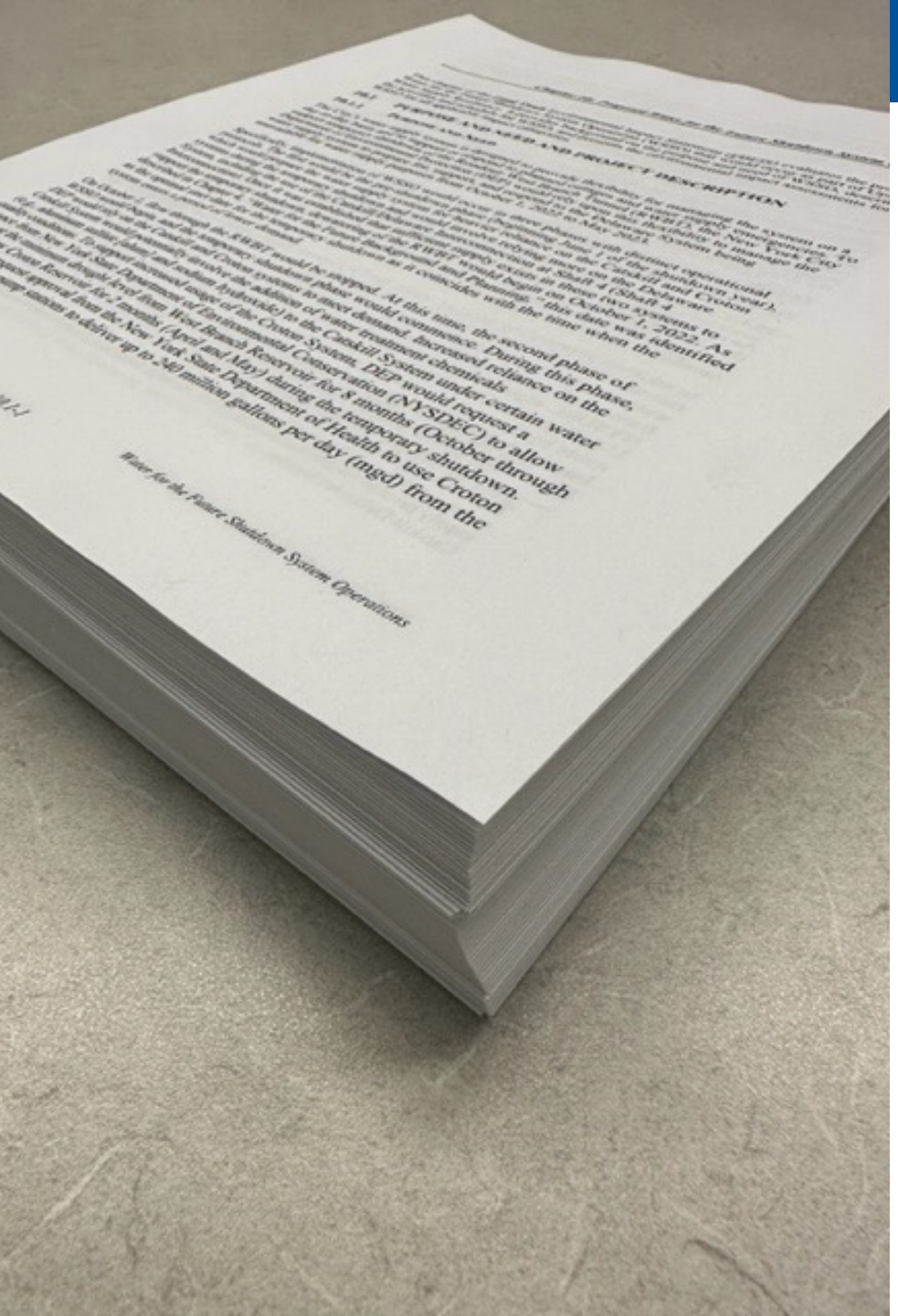
Higher than Anticipated Tunnel Infiltration Rates

- RWBT partial dewatering exercise in March showed higher infiltration/exfiltration rates than previously anticipated.
- Current dewatering pump design capacity is insufficient, which would cause infiltration water to flood the connection worksite.
- Pump and drainage augmentation work now anticipated to run through spring 2024



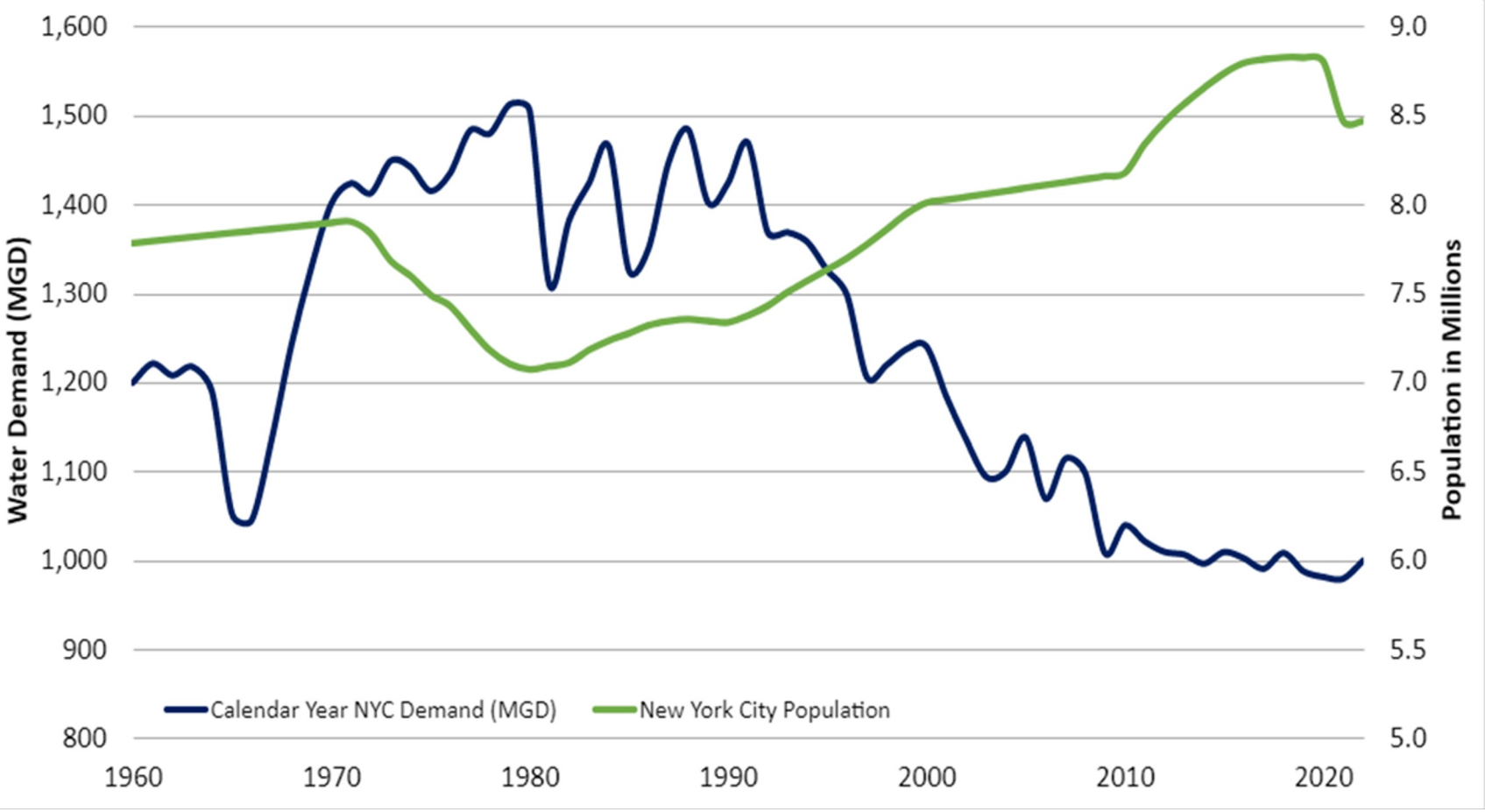


Getting to Today

- **Shutdown Management Plan was subject to a full environmental review process**
- Notice of Completion of Final Environmental Impact Statement was issued on December 15, 2017
- **Chapter 10: Proposed Water for the Future Shutdown System Operations 429 Pages**
- www.nyc.gov/assets/dep/downloads/pdf/environmental-reviews/upstate-water-supply-resiliency/chapter-10-wsso.pdf

Getting to Today

Conservation Savings



DEP instituted conservation strategies across residential, commercial, educational, industrial, and municipal customers that have reduced demand on the system to the lowest level in at least 60 years, even as population has increased.

Shutdown Management Plan (SMP) Overview

Meet water supply demands during the shutdown

Maintain high quality water during the shutdown

Mitigate risks to both water quality and supply reliability

A plan to provide uninterrupted, high-quality water to DEP's customers during the Rondout West Branch Tunnel bypass shutdown

Water Supply Augmentation

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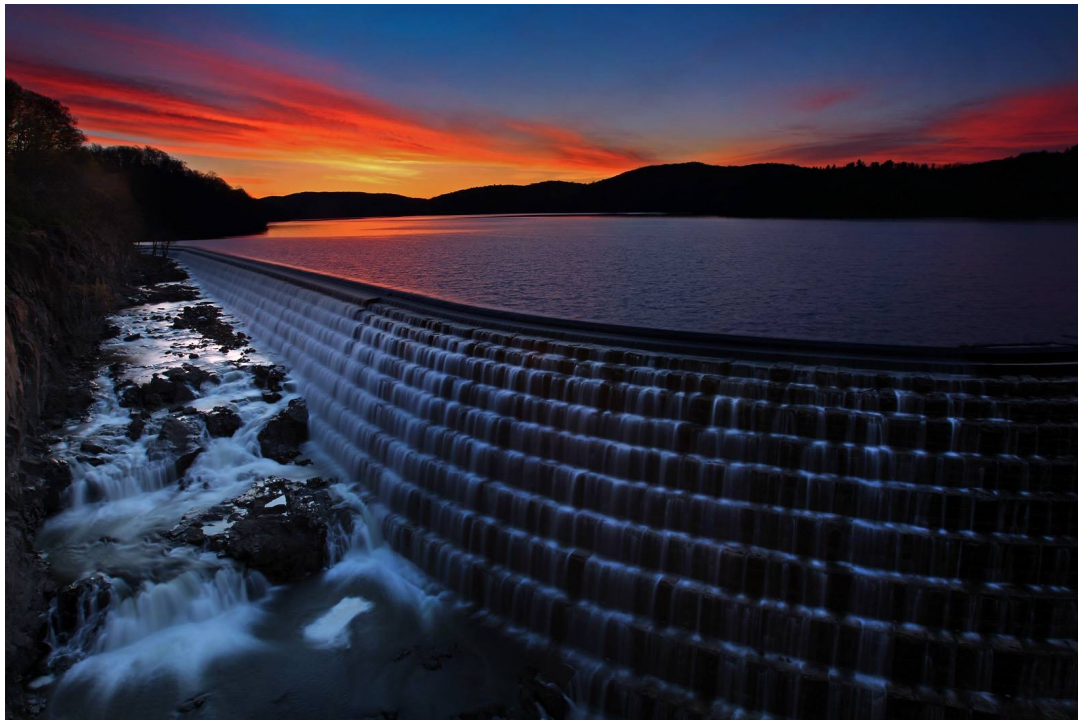
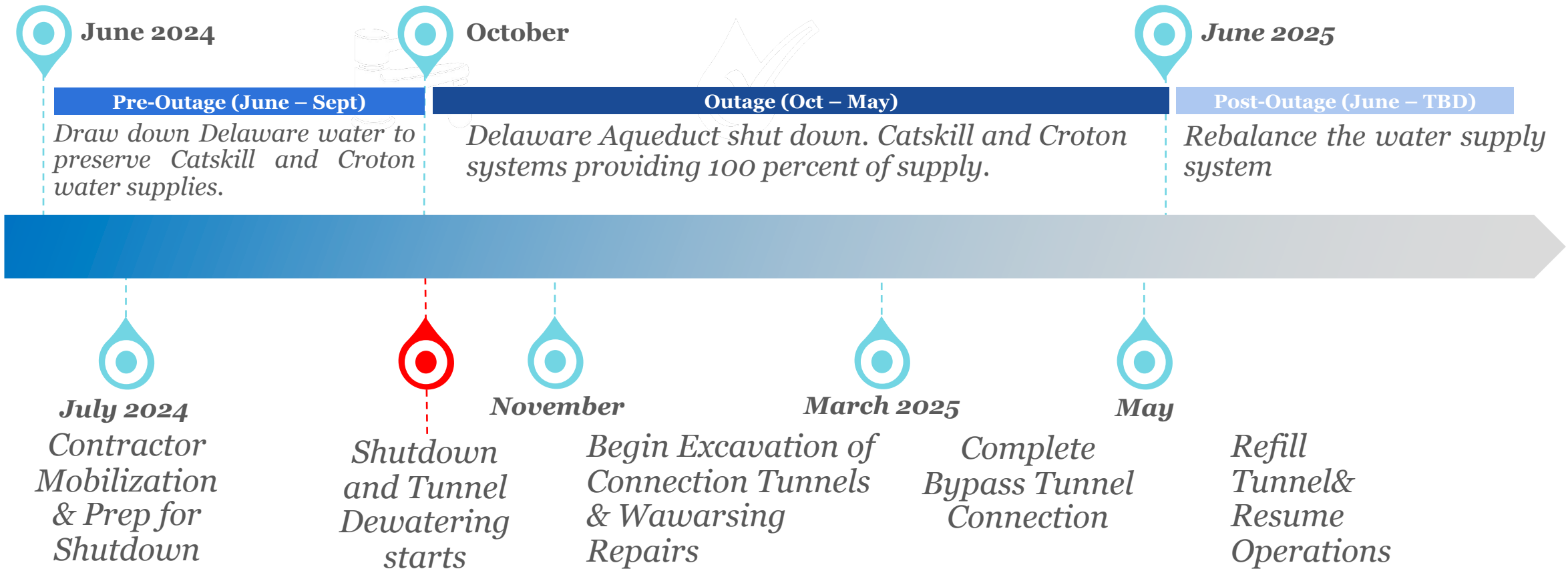
During the 8-month shutdown how will New York City meet demand?

Source	Max. Capacity
Catskill System	600 MGD
Croton Pump Stations	240 MGD
Croton System	290 MGD



Shutdown Operations and Tunnel Connection Timeline



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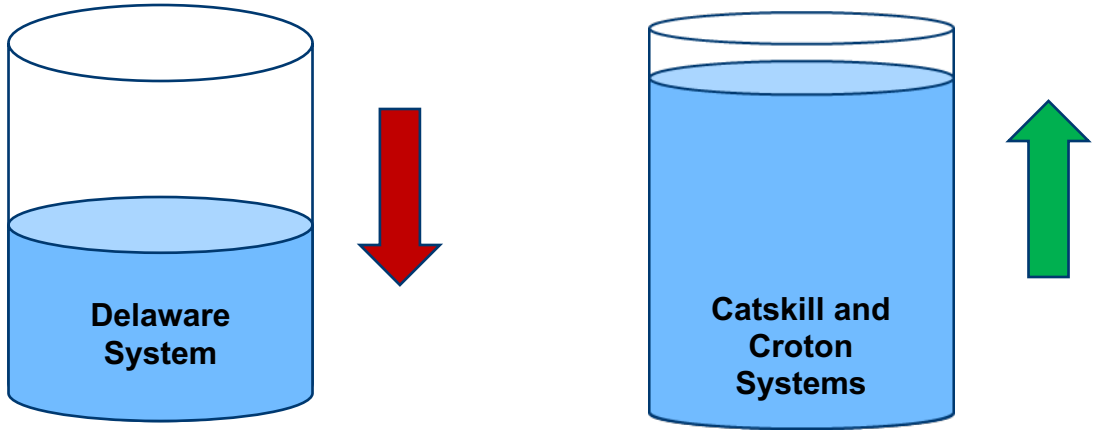
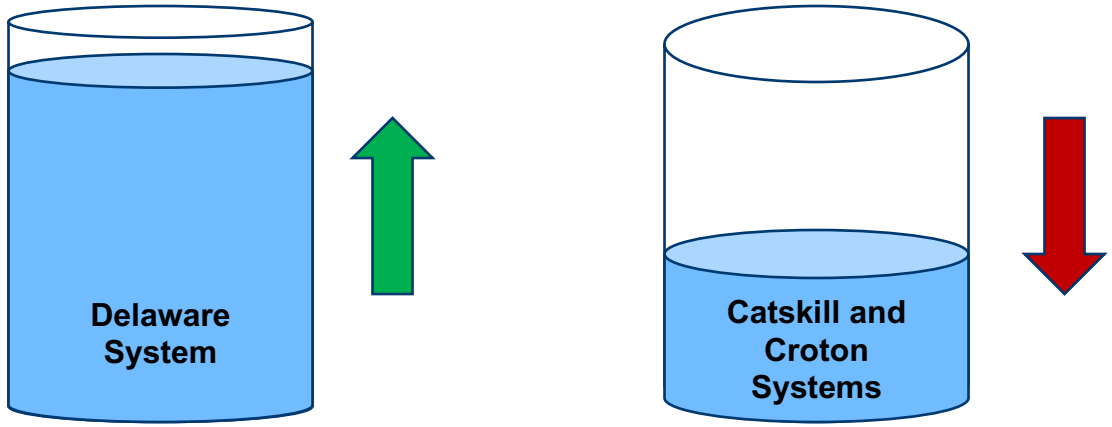
Shutdown Operations

Before the aqueduct shutdown

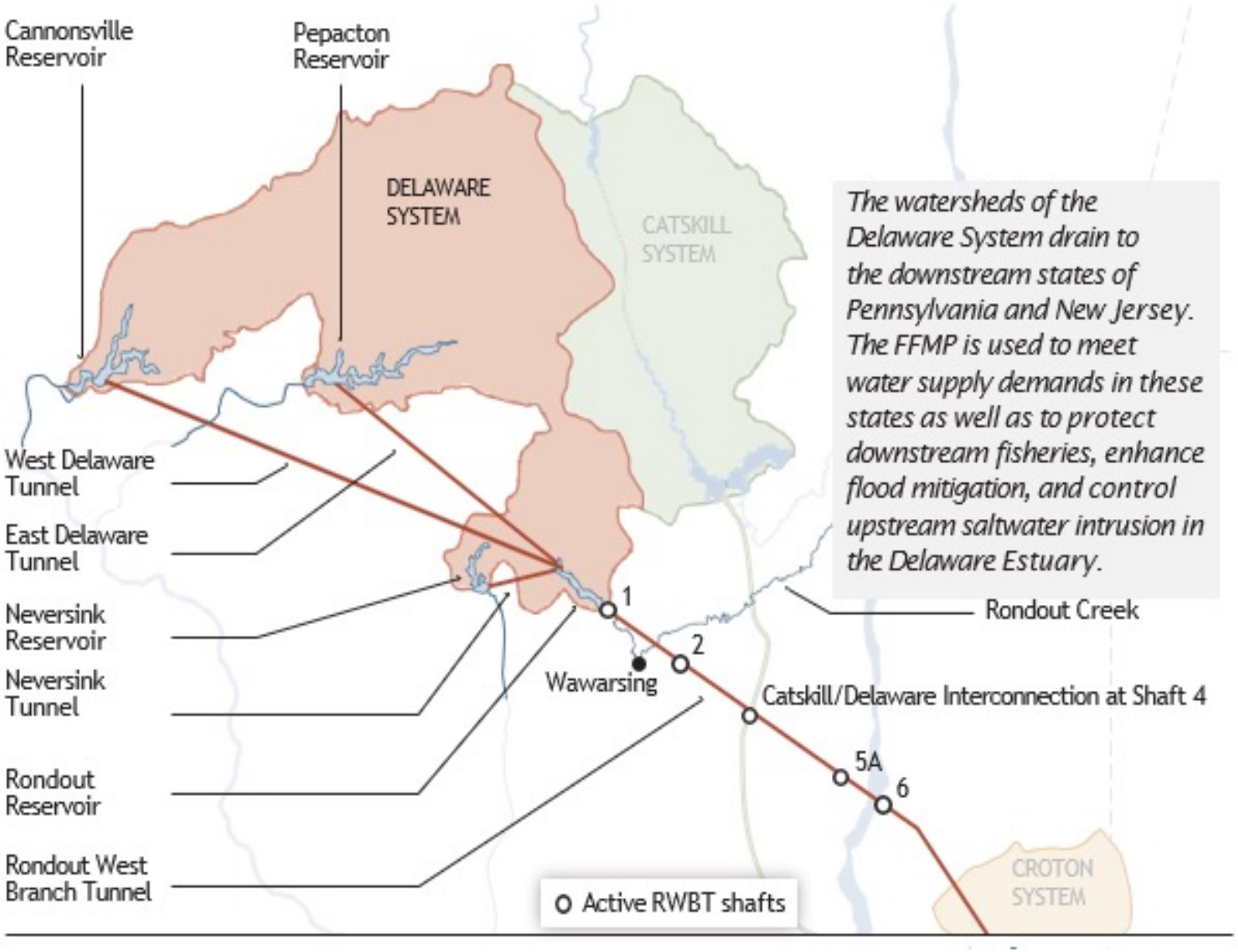


During the aqueduct shutdown



Delaware System Leading into the Shutdown

- Depending on rainfall, DEP expects to draw down the Cannonsville, Neversink and Pepacton reservoirs by 30 percent or more ahead of the shutdown
- Preserve Catskill system water for the shutdown

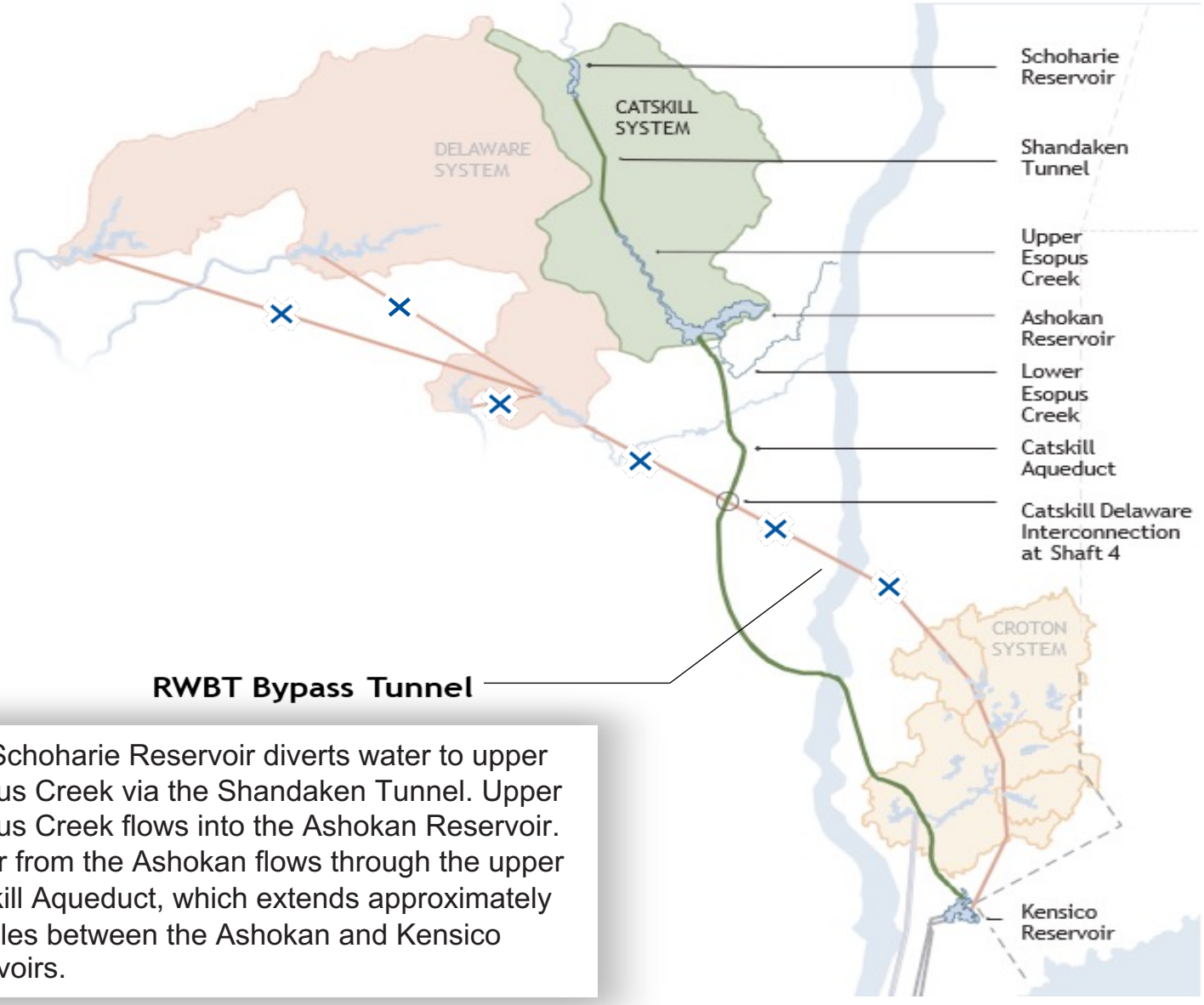


Delaware System Recreational Uses

- Permitted boating and fishing activities from shore or boat will be allowed on all reservoirs
- Boating (recreational and fishing) on the Neversink, Cannonsville, and Pepacton reservoirs will remain active for the entire season
- During periods with lower reservoir levels, access to the water may be more difficult for fishing and recreational boat users
- No restrictions will be placed on any land-based recreational activities, including hunting, hiking, or trapping

Catskill System During Delaware Shutdown

Starting October 1, 2024 the Delaware Aqueduct will shut down for up to eight months and the majority of the water supply will come from the Catskill System supplemented by the Croton System as contractors work to connect the bypass tunnel under the Hudson.



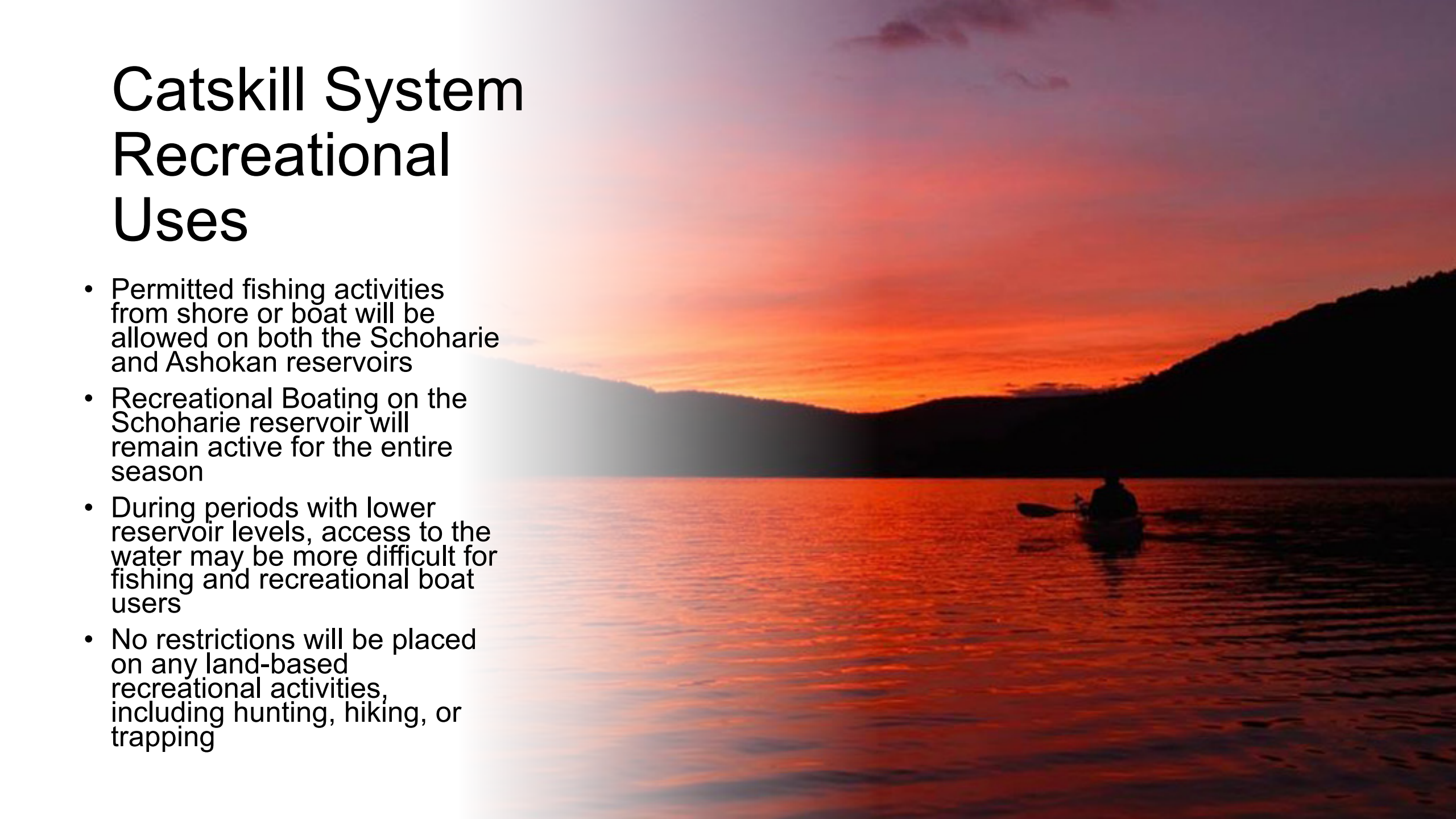
The Schoharie Reservoir diverts water to upper Esopus Creek via the Shandaken Tunnel. Upper Esopus Creek flows into the Ashokan Reservoir. Water from the Ashokan flows through the upper Catskill Aqueduct, which extends approximately 74 miles between the Ashokan and Kensico reservoirs.

Catskill System Expanded Waterfowl Management Program

- Longstanding management program has been in place at Kensico and Hillview Reservoirs to prevent contamination from wildlife waste
- Program includes monitoring of waterfowl and mitigating their effects on water quality
- Waterfowl are typically dispersed by motorboats combined with noisemakers (pyrotechnics)
- **During the shutdown period, DEP will use same practices at Ashokan Reservoir as needed to protect water quality, and they may be noticeable from the Ashokan Rail Trail and Promenade**
- **All activities are conducted pursuant to an Environmental Impact Statement to minimize and mitigate impacts to nontarget species, such as Bald Eagles**
  - protective buffers are maintained for Bald Eagle Nest Sites, in consultation with DEC and USFWS as needed
- Concerns can be directed to Director of Outreach John Milgrim at (845) 334-7868 or jmilgrim@dep.nyc.gov

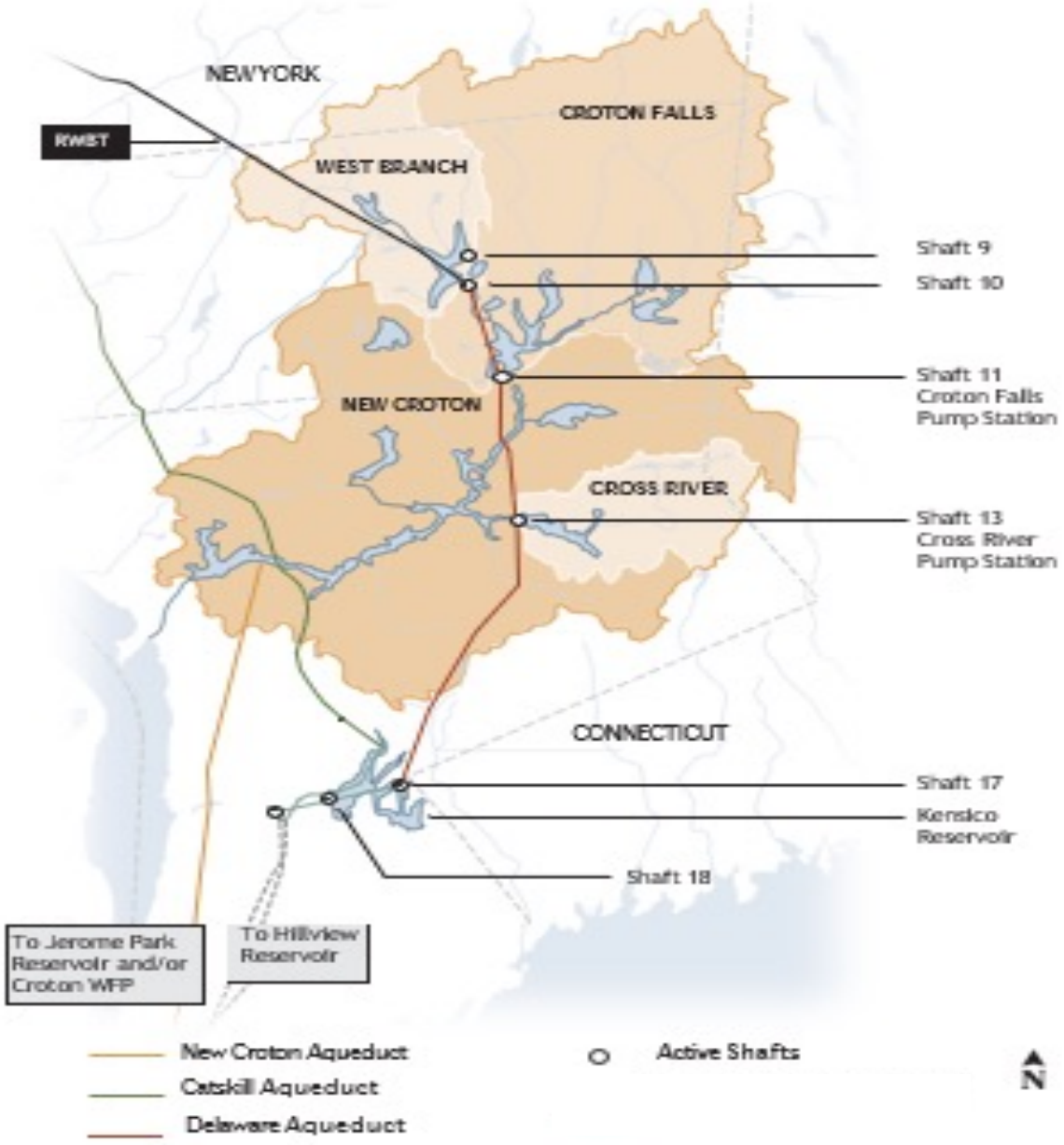
Catskill System Recreational Uses

- Permitted fishing activities from shore or boat will be allowed on both the Schoharie and Ashokan reservoirs
- Recreational Boating on the Schoharie reservoir will remain active for the entire season
- During periods with lower reservoir levels, access to the water may be more difficult for fishing and recreational boat users
- No restrictions will be placed on any land-based recreational activities, including hunting, hiking, or trapping



Outage Operations – Croton System

The Croton System, the oldest watershed in the City's supply system, will be tapped at full capacity during the Delaware Shutdown period and treated as four separate subsystems. Additionally, pump stations will supplement water into the lower Delaware Aqueduct



Croton System Episodic Taste and Odor Issues

- In recent years, there have been episodic taste and odor issues from the Croton System attributed to naturally occurring organic compounds
- Up to and during the shutdown period, DEP will enhance water quality monitoring as well as treat for any known nuisance algae that may have the potential to produce taste and odor compounds
- DEP has also installed granular activated carbon (GAC), an effective treatment for removal of taste and odor compounds, at its treatment plant to further mitigate any potential issues occurring during the project
- As the Croton System will be more heavily relied on to augment supply in the City and certain Westchester communities during the shutdown, it should be noted that ecologies in the different watershed systems can naturally result in subtle flavor variations in the water supply

Croton System Expanded Waterfowl Management Program

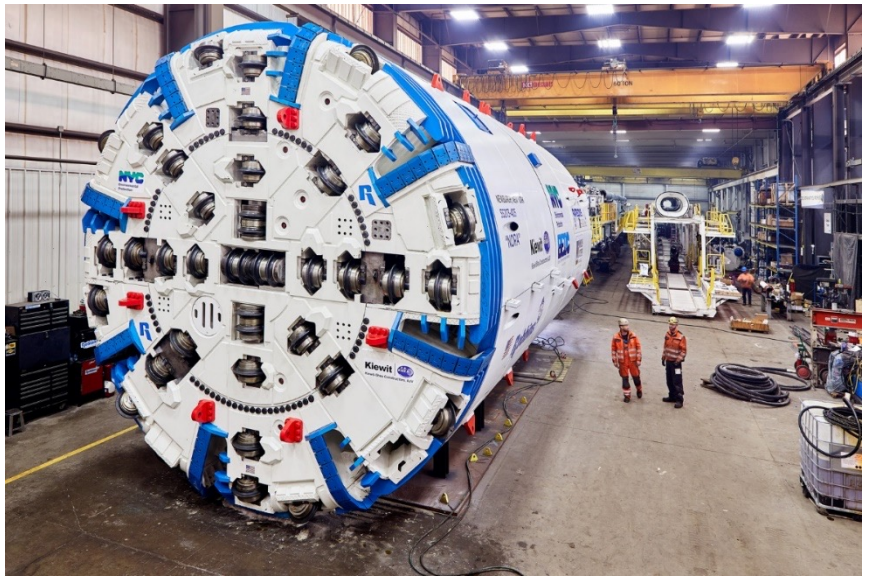
- Longstanding management program has been in place at Kensico and Hillview Reservoirs to prevent contamination from wildlife waste
- Program includes monitoring of waterfowl and mitigating their effects on water quality
- Waterfowl are typically dispersed by motorboats combined with noisemakers (pyrotechnics)
- During the shutdown period, DEP will use same practices at Boyd's Corners, West Branch, Cross River, and Croton Falls Reservoirs as needed to protect water quality
- All activities are conducted pursuant to an Environmental Impact Statement to minimize and mitigate impacts to nontarget species, such as Bald Eagles
  - Protective buffers are maintained for Bald Eagle Nest Sites, in consultation with DEC and USFWS as needed
- Concerns can be directed to Director of Outreach John Milgrim at (845) 334-7868 or jmilgrim@dep.nyc.gov

Croton System Recreational Uses

- Permitted fishing activities from shore or boat will be allowed on all reservoirs
- During periods with lower reservoir levels, access to the water may be more difficult for fishing boats
  - DEP will allow anglers to store fishing boats closer to the water during low water conditions
- No restrictions will be placed on any land-based recreational activities, including hunting, hiking, or trapping
- In-stream discharges (releases from reservoirs) will be reduced and may impact stream fishing
- Due to water level fluctuations, Ice fishing will be restricted on several Croton system reservoirs during the winter 2024-2025 season

Summary

- The Rondout to West Branch Tunnel shutdown planning started more than 20 years ago
- Multiple required predecessor projects needed to be successfully completed prior to this point
- The water supply management plan is based on extensive computer modeling and engineering experience and is subject to state and federal regulatory review and oversight
- DEP will continue reviewing multiple data points and projections, and conduct continuous systems monitoring and testing up to and throughout the shutdown



Questions?

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